Reactively Loaded Sparse Antenna Arrays

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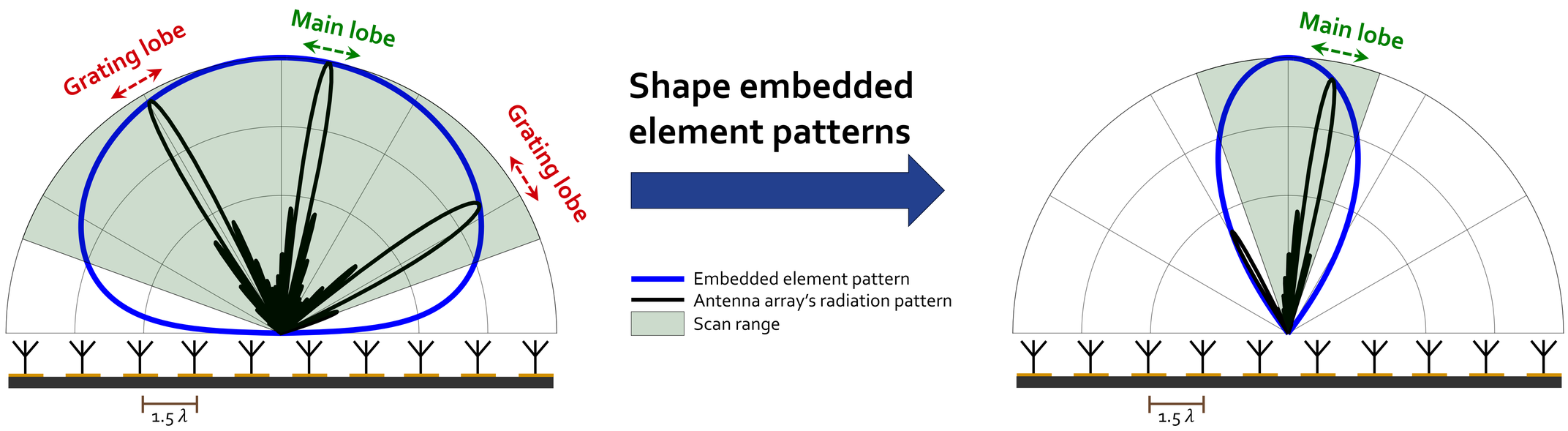
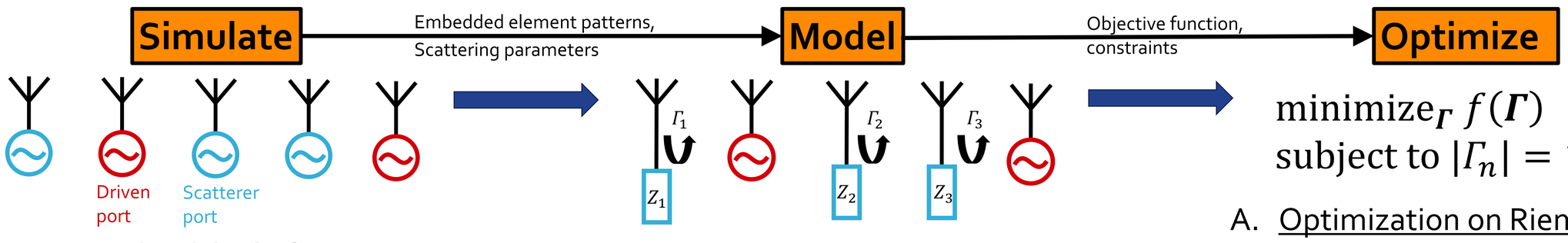
Objective: Grating-lobe free beam steering



Shaped embedded element patterns limit the antenna array's scan range into the grating-lobe-free window.

Synthesis using reactive scatterers

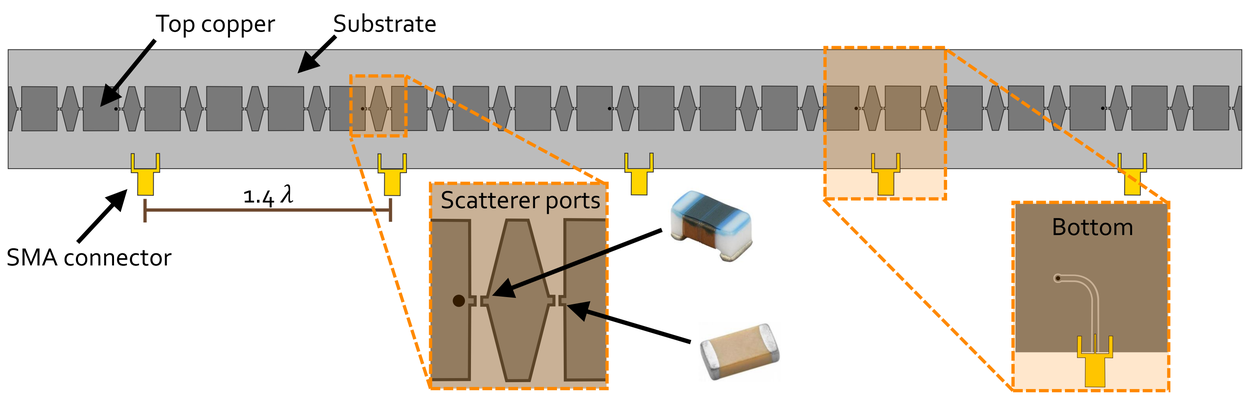


Get embedded element patterns and scattering parameters by exciting both driven and scatterer ports.

Replace excitations of scatterer ports by reflection coefficients Γ_n and formulate the objective function $f(\boldsymbol{\Gamma})$.

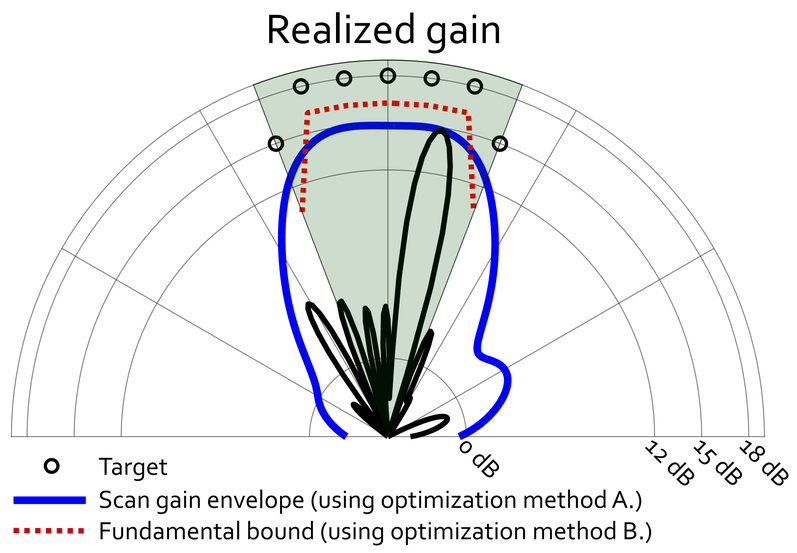
A. Optimization on Riemannian manifold
B. Semidefinite relaxation
C. Dimensionality reduction with principal component analysis
D. Genetic algorithm

Realization of a reactively loaded sparse antenna array



Connected patch-diamond array with 40 scatterer ports terminated to surface-mounted components.

Result



1. A. Salmi, J. Bergman, A. Lehtovuori, J. Ala-Laurinaho and V. Viikari, "**Grating-Lobe Mitigation Using Parasitic Scatterers and Principal Component Analysis**," in *IEEE Transactions on Antennas and Propagation*, 2024.
2. A. Salmi, J. Bergman, A. Lehtovuori, J. Ala-Laurinaho and V. Viikari, "**Improving Scan Gain of Sparse Vivaldi Array with Parasitic Scatterers**," in *European Conference on Antennas and Propagation (EuCAP)*, 2024. [accepted].